UNITED
NATIONS

A

General Assembly

Distr.
GENERAL

A/AC.105/541
5 February 1993

ORIGINAL: ENGLISH

COMMITTEE ON THE PEACEFUL USES
OF OUTER SPACE

# INTERNATIONAL MARITIME SATELLITE ORGANIZATION
# ANNUAL REVIEW 1991

Note by the Secretariat

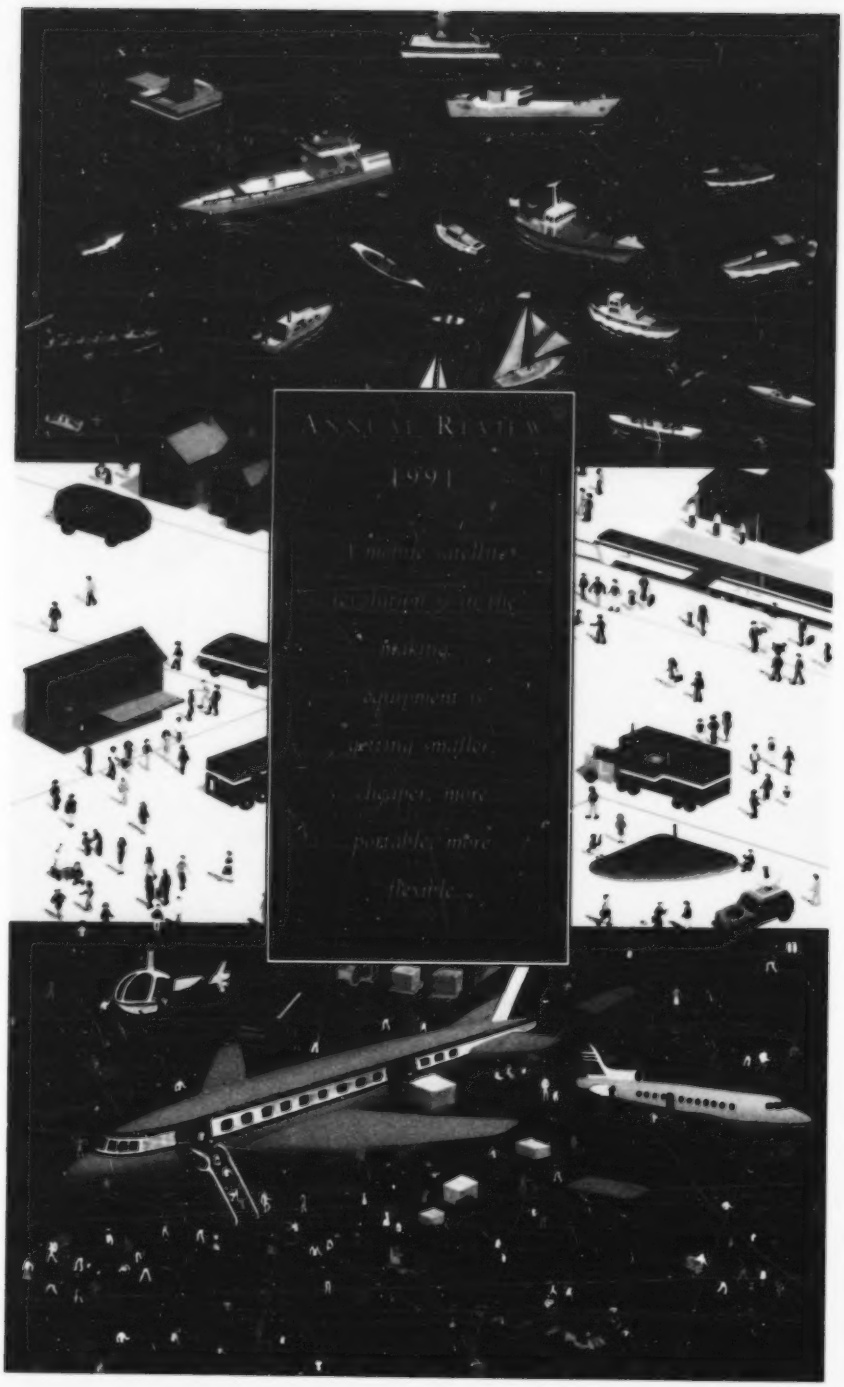
The International Maritime Satellite Organization (INMARSAT) has submitted the attached report 1/ on its activities during the year 1991 for the information of the Committee on the Peaceful Uses of Outer Space. The report is available in English, French, Russian and Spanish.

Notes

1/ In view of the limited number of copies received, the report is distributed to the members of the Committee only.

---

93-07606 3773g (E) 080293 10/02/93




Inmarsat

The phrase global mobility has begun to gain currency over the past year. The vision is of a truly global, mobile communications system enabling anyone, anywhere, to communicate effortlessly with anyone else, anywhere else.

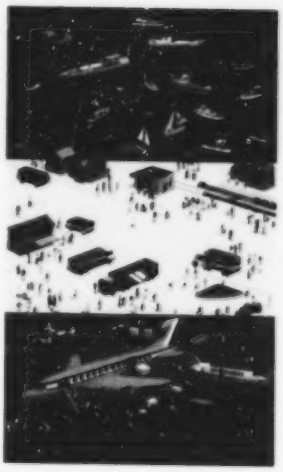
For the worldwide customers of the Inmarsat system, however, the vision is already a commonplace, as routine as dialling a number.

While our largest market remains the maritime community, land mobile services are growing quickly and Inmarsat's aeronautical service now offers full communications to aircraft in flight.

Mobile-satellite technology is developing rapidly and Inmarsat remains at the leading edge of these developments. Equipment is shrinking, becoming more portable and cheaper to buy and use. New services, new applications and new markets are opening up as the technology becomes more and more accessible to more and more people.

Our systems and the services provided by our Signatories are helping customers to communicate in more than 130 countries around the world, 64 of which are Inmarsat members. Indeed, there are few places on the planet that Inmarsat cannot reach.

At Inmarsat, we deal daily with a changing world. In many respects we are helping to create it. Our continued success demands a nimble, flexible organisation and a climate open to new ideas and new ways of doing business. We are fortunate that our staff, who come to us from 52 countries around the world, not only accept these challenges but thrive on them.



CONTENTS

2 - 3
*Inmarsat Members*

4
*A growing family of services*

4
*Four region coverage*

5
*Director General's message*

6 - 7
*Inmarsat in 1991*

8 - 11
*The evolving Inmarsat systems*

12 - 15
*Maritime Services*

16 - 19
*Aeronautical Services*

20 - 23
*Land Mobile Services*

24
*Navigation*

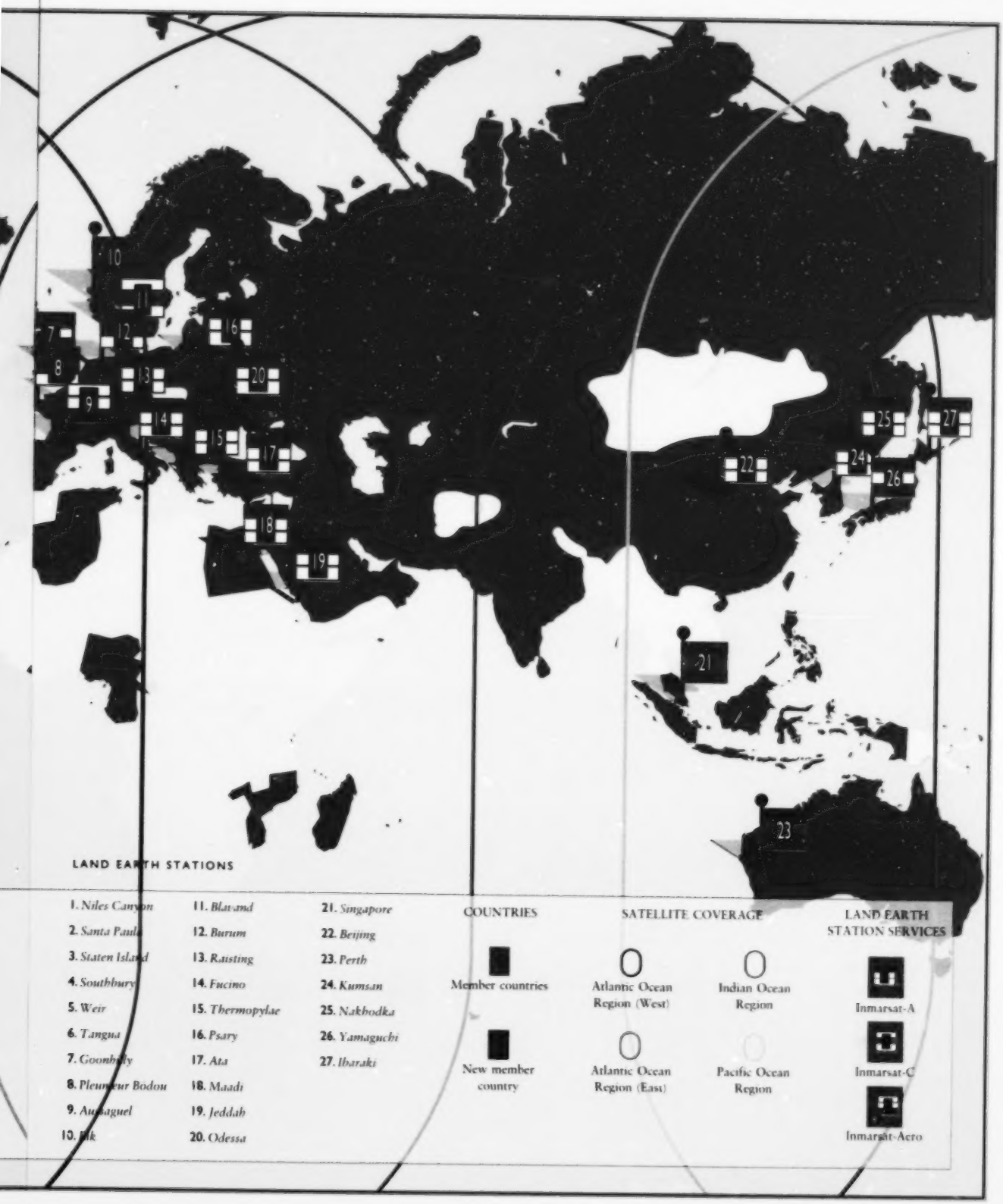
25
*Notes on the Year*

26 - 28
*Signatories & Officers*

READEX
FICHE

**MEMBER COUNTRIES**

| | | | | | | |
|---|---|---|---|---|---|---|
| USA | Singapore | Korea, Republic of | China, People's Republic of | Liberia | Gabon | Malta |
| Norway | Italy | Belgium | Indonesia | Malaysia | Chile | Mozambique |
| United Kingdom | Germany | Poland | Portugal | Philippines | Algeria | Nigeria |
| Japan | Spain | India | Kuwait | Qatar | Cameroon | Oman |
| France | Canada | Switzerland | Egypt | Morocco | Colombia | Pakistan |
| Russian Federation | Australia | Iran | Argentina | Turkey | Cuba | Peru |
| Netherlands | Brazil | Finland | New Zealand | Bahrain | Czechoslovakia | Romania |
| Greece | Suadi Arabia | United Arab Emirates | Bulgaria, Republic of | Yugoslavia | Iceland | Sri Lanka |
| Denmark | Sweden | | | Panama | Iraq | Tunisia |
| | | | | Israel | | |




LAND EARTH STATIONS

| | | |
|---|---|---|
| 1. *Niles Canyon* | 11. *Blavand* | 21. *Singapore* |
| 2. *Santa Paula* | 12. *Burum* | 22. *Beijing* |
| 3. *Staten Island* | 13. *Raisting* | 23. *Perth* |
| 4. *Southbury* | 14. *Fucino* | 24. *Kumsan* |
| 5. *Weir* | 15. *Thermopylae* | 25. *Nakhodka* |
| 6. *Tangua* | 16. *Psary* | 26. *Yamaguchi* |
| 7. *Goonhilly* | 17. *Ata* | 27. *Iharaki* |
| 8. *Pleumeur Bodou* | 18. *Maadi* | |
| 9. *Aussaguel* | 19. *Jeddah* | |
| 10. *Eik* | 20. *Odessa* | |

COUNTRIES

Member countries

New member country

SATELLITE COVERAGE

Atlantic Ocean Region (West)

Indian Ocean Region

Atlantic Ocean Region (East)

Pacific Ocean Region

LAND EARTH STATION SERVICES

Inmarsat-A

Inmarsat-C

Inmarsat-Aero

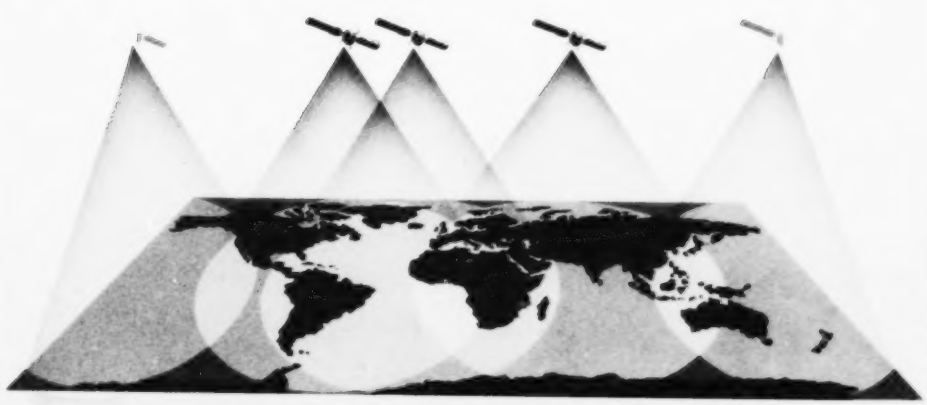
## A GROWING FAMILY OF SERVICES

*High speed data*
*Low speed data*
*Facsimile*
*Telephone*
*Telex*
*Maritime*
*Land mobile*
*Land transportable*
*Aeronautical*
*Personal*

| SERVICE | FEATURES | REMARKS | MARKETS | DATE |
|---|---|---|---|---|
| Inmarsat-A | | Full service, high quality terminal | | *Introduction* 1982 |
| Inmarsat-C | | Low-cost portable | | *Introduction* 1990 |
| Inmarsat Aero-L | | Commercial, business and private aircraft | | *Introduction* 1990 |
| Inmarsat Aero-H | | Commercial and larger business aircraft | | *Introduction* 1990 |
| Inmarsat-B | | Full service, high quality digital terminal | | *Introduction* 1992 |
| Inmarsat-M | | Medium quality, lower cost digital portable | | *Introduction* 1992 |
| Inmarsat-E | | Instant maritime distress alerting system | | *Introduction* 1992 |
| Inmarsat Paging | | Pocket-sized, global paging system | | *Introduction* 1994 |
| Inmarsat Navigation Services | | A range of services for navigation purposes | | *Introduction* mid 1990's |
| Inmarsat-P | | Hand-held, low-cost global satellite telephone | | *Possible Introduction by* 2000 |

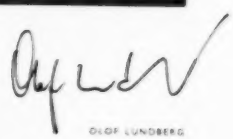
## FOUR-REGION COVERAGE

*Atlantic Ocean-W Region*
*Atlantic Ocean-E Region*
*Indian Ocean Region*
*Pacific Ocean Region*



Inmarsat today is, by any measure, a successful organisation. In 1991, traffic and revenues have recorded their highest increases ever.

While we strive to provide the best services to our current customers, we are working hard to advance the technology of mobile-satellite communications. Our aim is to speed the introduction of new services to new generations of mobile-satellite terminals - smaller, more flexible and cheaper to buy and use.



OLOF LUNDBERG
DIRECTOR GENERAL

These advancements are quickly bringing the benefits of mobile-satellite technology to many more people around the world than has previously been possible.

Our services, a few short years ago, were confined to the maritime market. Today, our markets are growing rapidly on land and reach aircraft in flight.

With our second-generation satellite system now in service, construction begun on our third, and planning for subsequent generations underway, our satellite systems are also evolving to keep pace with increased demands and services.

The 64 Inmarsat member countries, their Signatories and our international staff share with me a simple but common commitment: to remain at the leading edge of technology and customer service now and in the future.

AN OVERVIEW: *The year 1991, as well as being a financial success, has seen Inmarsat active on many fronts as it moves aggressively to put into place new satellite technology and new services. Our focus is to ensure that existing customers at sea, in the air and on land obtain the best service possible, while at the same time to develop and introduce new systems and to plan for technically advanced future services.*

### HIGHLIGHTS OF THE YEAR:

- Maritime and land mobile markets continued to expand dramatically.
- On 4 January 1991, commercial Inmarsat-C service began, providing communications to small, portable data terminals.
- By the end of the year, almost 100 commercial and corporate aircraft were taking advantage of Inmarsat's aeronautical service, introduced commercially in November 1990.
- Inmarsat decided it would introduce a global paging service in 1994.
- A number of Signatories built or announced plans to build new land earth stations to support both traditional and new services.
- Inmarsat continued its establishment of a second-generation satellite system by launching and placing into service two new satellites during the year.
- In February 1991, Inmarsat signed a contract with GE Astro for the provision of a third-generation satellite system for launch in 1994/95.
- In September 1991, Inmarsat announced its Project 21 initiative, under which it is planning the evolution of systems and services into the 21st century, including personal mobile-satellite communications and the development of hand-held satellite phone services before the end of the decade.

Two countries became new Parties to the Inmarsat Convention, raising the number of Inmarsat members to 64: Malta on 11 January 1991 and Iceland on 26 March 1991.

### FINANCIAL AND TRAFFIC SUMMARY

In 1991, Inmarsat has recorded its most successful year ever with traffic and revenue growth exceeding both past performances and forecasts.

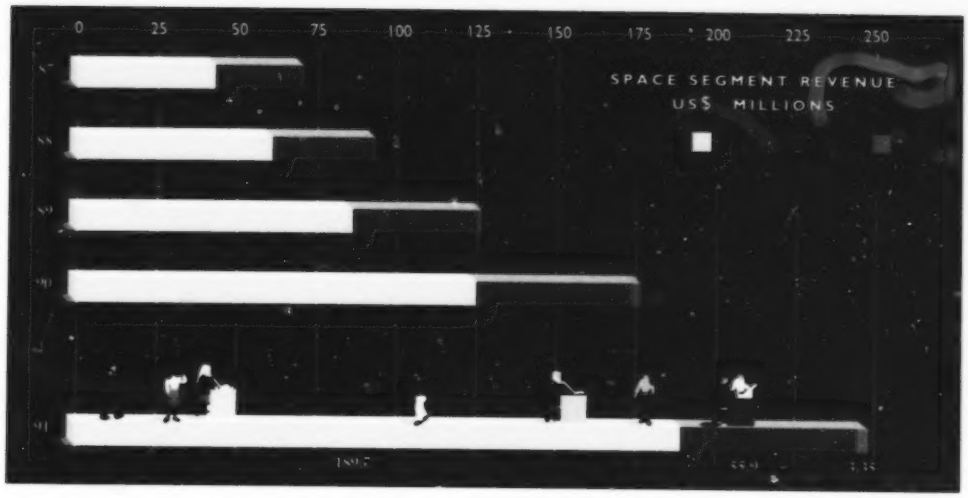
The increase was due mainly to the growth in the number and use of Inmarsat-A terminals. The most significant growth occurred in the Atlantic and Indian Ocean Regions as the first two second-generation satellites came into service, increasing available capacity in these regions. The new Inmarsat-C and Inmarsat-Aero services will have a progressively larger impact on Inmarsat revenues in the year ahead.

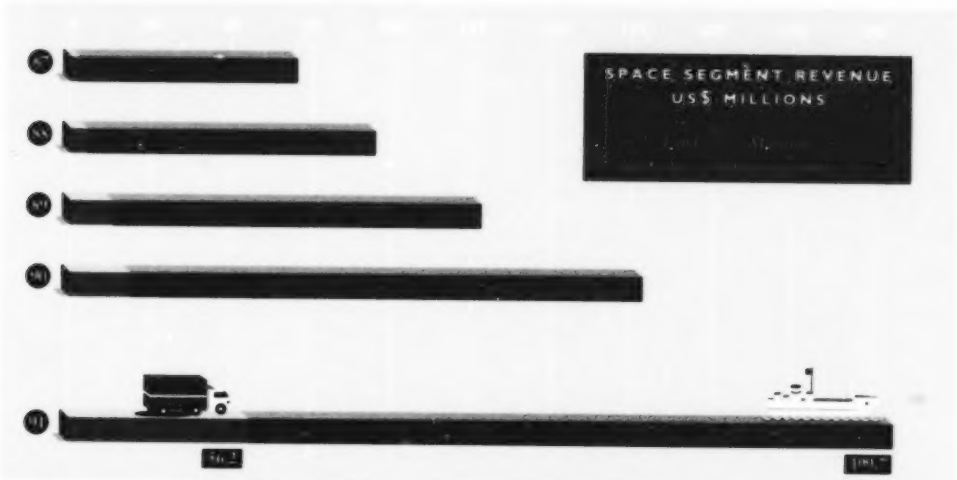
Total revenues reached US$261.3 million, a 44% increase over 1990. Space segment revenues – at US$256.1 million – were up by 45% over the previous year. Of this amount, 78% was generated from maritime services, 21.9% from land mobile services and 0.1% from newly introduced aeronautical services.

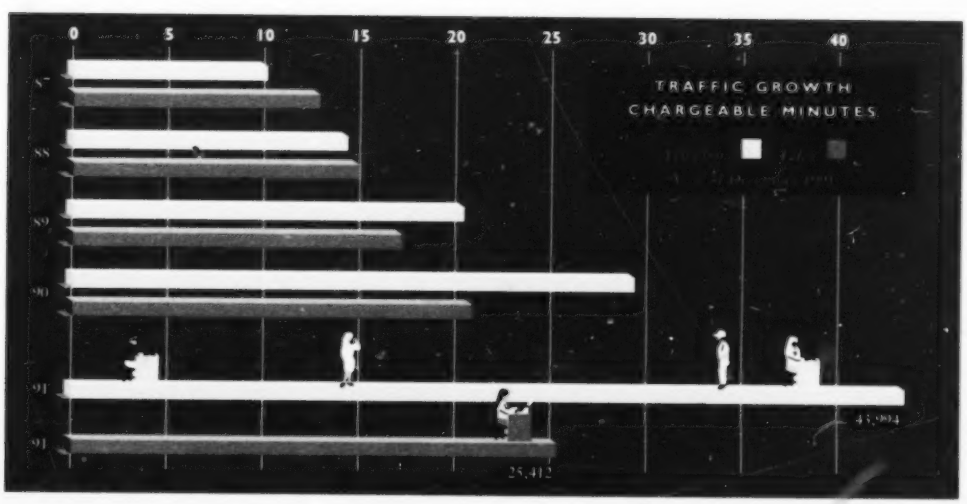
Telephone services provided the main source of revenue, $189.7 million, up by 50.2% over 1990.

Telephone traffic reached 43,994 million chargeable minutes, a 51% increase over 1990. Total telex traffic was 25,412 minutes, up 23%.

With these successful revenue results and the impact of a satellite finance lease arrangement for the second-generation satellite system, which provides substantial long-term financial benefits, Inmarsat was able to exceed its requirements with respect to Signatory return on capital and is well placed to enable the introduction of increasingly cost-effective services.


0
25
50
75
100
125
150
175
200
225
250
SPACE SEGMENT REVENUE
US$ MILLIONS


SPACE SEGMENT REVENUE
US$ MILLIONS

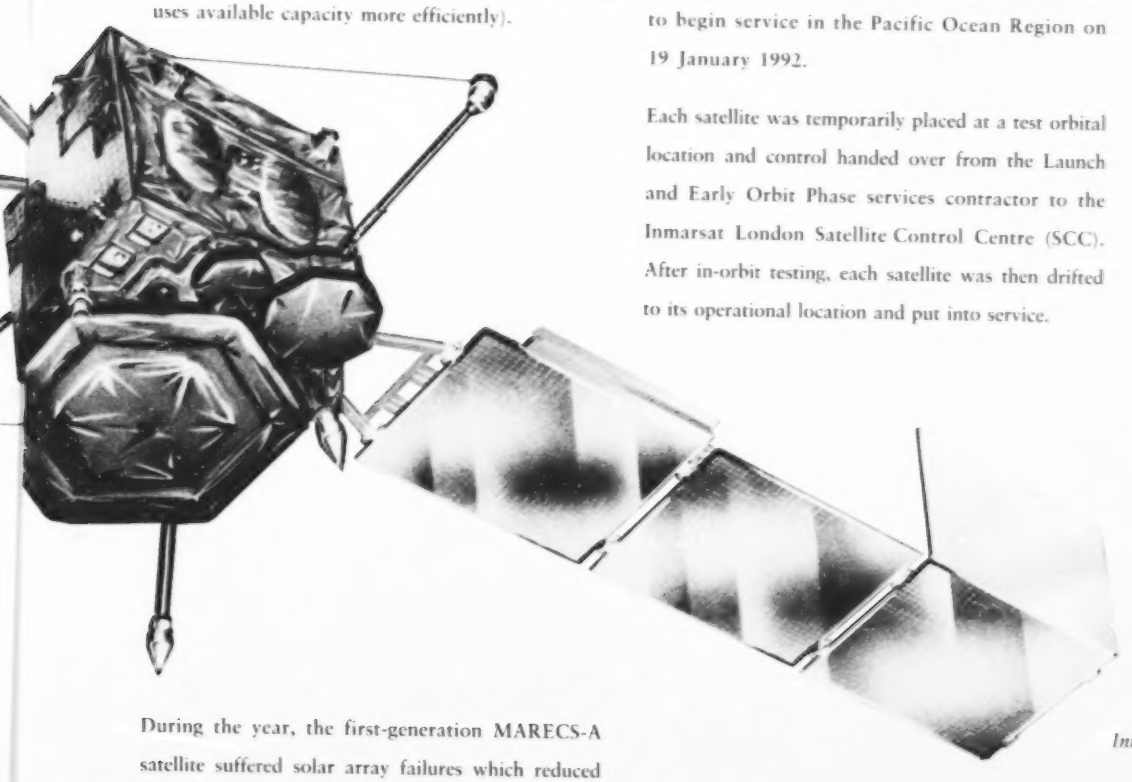

0
5
10
15
20
25
30
35
40
TRAFFIC GROWTH
CHARGEABLE MINUTES

*Inmarsat operates and develops its global satellite system and associated ground networks under a strategy designed to enhance its existing services and provide increased capacity and power to meet the escalating demand for new mobile-satellite services. In 1991, a second-generation of satellites was being launched, while construction began on the next, third-generation satellite system for the mid-1990s.*

### FIRST-GENERATION SPACE SEGMENT

As Inmarsat began deploying a second-generation satellite system in 1991, the first-generation operational satellites were being shifted to spare or standby status. They are near the end of their useful life.

Until the deployment of the new satellites in each Inmarsat region, however, steps were taken to increase the capacity of the eight-satellite, first-generation space segment. These included dual satellite operation (with both operational and spares in active use) and full carrier suppression (which uses available capacity more efficiently).



*Inmarsat-2*

During the year, the first-generation MARECS-A satellite suffered solar array failures which reduced its capacity and was retired from service in the Pacific Ocean Region. A MARISAT satellite, previously a backup, was returned to operational service to help carry traffic until the second-generation satellite for that region was brought into service in early 1992.

### SECOND-GENERATION SATELLITE SYSTEM

The installation of Inmarsat's four-satellite, second-generation satellite system–Inmarsat-2–after three successful launches, was nearing completion by the end of the year.

Following the first launch in 1990, a Delta launch vehicle lifted the second satellite into orbit from Cape Canaveral on 8 March 1991. It began service over the Atlantic Ocean Region-East on 13 April. The third satellite was sent aloft by an Ariane launch vehicle from Kourou on 16 December 1991 to begin service in the Pacific Ocean Region on 19 January 1992.

Each satellite was temporarily placed at a test orbital location and control handed over from the Launch and Early Orbit Phase services contractor to the Inmarsat London Satellite Control Centre (SCC). After in-orbit testing, each satellite was then drifted to its operational location and put into service.

By the end of the year, the fourth and final second-generation satellite was at the launch site under-going final preparation for a 15 April 1992 launch.

The L-band power (EIRP) of each Inmarsat-2 series satellite is 39 dBW. Capacity is about two-and-a-half times that of the largest first-generation predecessor.

The Inmarsat SCC operates the spacecraft using Tracking, Telemetry, Command, Ranging and Monitoring (TTCR&M) stations at Fucino, Italy, and Beijing, People's Republic of China. A third TTCR&M station at Southbury, Connecticut in the USA, will support the fourth satellite, and a fourth at Santa Paula, California in the USA, will act as a backup for the Southbury and Beijing stations.

Inmarsat has a finance lease arrangement for three second-generation satellites with North Sea Marine Leasing Company. The lease payment period for the first second-generation satellite began during 1991.

### THIRD-GENERATION SATELLITE SYSTEM

Even as Inmarsat's second-generation satellite system was coming on stream, the organisation was completing its plans for a third, more powerful, more flexible generation – Inmarsat-3, for launch in 1994/5.

Inmarsat awarded a contract on 1 February 1991 for four Inmarsat-3 satellites to the prime contractor General Electric Astro Space Division (GE Astro) in Princeton, New Jersey, USA. GE Astro has responsibility for overall spacecraft design, manufacturing, assembly and testing. The communications payload subcontract has been awarded by GE Astro to Marconi Space Systems Ltd in Portsmouth, UK. The Inmarsat-3 project team – some 25 staff – is located on site at the GE Astro and Marconi premises.

A request for proposals was issued in August 1991 for Inmarsat-3 launch contracts, attracting five bidders. Contracts will be awarded in 1992. The satellites will be controlled in orbit by the Inmarsat SCC.

Each Inmarsat-3 series satellite will have an L-band power (EIRP) of up to 48 dBW. Featuring a global beam and five spot beams, each satellite is designed to be extremely spectrum efficient. Inmarsat-3 will support smaller, less-expensive mobile-satellite terminals.

The third-generation satellites will also include a navigation payload for the development of an international civil complement to national satellite navigation systems. Other features include an L-band-to-L-band link to allow direct mobile-to-mobile communications via the satellite.

Three of the satellites are to be covered by a finance leasing arrangement.

### PROJECT 21: TOWARDS THE HAND-HELD SATELLITE PHONE

Dramatic advances in technology and shrinking satellite terminals will provide a growing family of "personal" mobile-satellite services which Inmarsat

will introduce progressively during the 1990s. The advances will also make practicable, in a very few years, the dream of a global, hand-held satellite phone, inexpensive to buy and use.

In September 1991, Inmarsat announced its Project 21 initiative which provides a focus for planning the evolution of advanced personal mobile-satellite systems

and services, including the introduction of the hand-held satellite phone before the end of the century.

To translate intention into reality, Project 21 planners are defining advanced satellite systems, the associated ground networks and terminal specifications for a hand-held satellite phone service for investor review in 1992.

### NETWORK COORDINATION CENTRE (NCC)

The Inmarsat NCC exercises overall coordination of network operation from Inmarsat's Headquarters, maintaining continuous contact with Inmarsat-A Network Coordination Stations (NCS) and Land Earth Stations (LES) in all four ocean regions. It has access to the orderwire, which connects NCSs and LESs via the operational satellite in each ocean region. The NCC also remotely controls, via leased data links, the Inmarsat-C NCSs in each ocean region. The four Inmarsat operating regions include the Pacific Ocean Region (POR), the Indian Ocean Region (IOR), the Atlantic Ocean Region-East (AOR-E) and the Atlantic Ocean Region-West (AOR-W).

### GROUND SEGMENT

Land Earth Stations (known as Coast Earth Stations for maritime services and Ground Earth Stations for aeronautical services) provide the link between the satellite and international public telecommunications networks and are owned and operated by Inmarsat service providers. The number of Land Earth Stations operating to the Inmarsat system as at 31 December 1991 was as follows: Inmarsat-A – 24; Inmarsat-C – 8; Inmarsat-Aero – 10.

### SPECTRUM AND FREQUENCY COORDINATION

The rapid expansion in services and markets and the evolution of personal mobile-satellite communications will lead inevitably to a need for increased radio frequency allocations.

In preparation for the International Telecommunications Union (ITU) World Administrative Radio Conference in February 1992 (WARC 92), Inmarsat (during the year) identified and made known the minimum additional requirements for mobile-satellite services and presented papers to various ITU Consultative Committee meetings examining the issue.

Because of the limited L-band spectrum and the characteristics of mobile-satellite networks, it will be difficult to meet the projected requirements of all the mobile-satellite operators who have indicated their intentions to provide services. There is no easy solution to co-ordination and frequency sharing.

Inter-system coordination of first-generation networks under ITU Radio Regulations, and under the auspices of the International Frequency Registration Board (IFRB), is the responsibility of the lessors of the space segment. Inmarsat participates in such technical coordinations. Inter-system coordination between INTELSAT and the former USSR Administration restricts Inmarsat's ability to use some of the bandwidth on its first generation networks.

Coordination agreements have yet to be concluded with many administrations for Inmarsat-2 networks. The characteristics of modern mobile-satellite terminals with omnidirectional antennas make coordination difficult to achieve between Inmarsat global beam networks and other global beam or spot beam networks within any overlapping coverage areas. Discussions continue.

The coordination process is also being pursued with respect to the Inmarsat-3 satellite networks.

Bjorn Barstad
Norwegian Telecom

Stephanie Collins
Inmarsat

Johannes Tvedte
Leif Hoegh, Norway

*Although markets are expanding for aeronautical and land mobile services, our traditional maritime service is still Inmarsat's largest market and biggest revenue earner. The market for Inmarsat's original Inmarsat-A service continued to expand in 1991, particularly among fishing boats and yachts, and the introduction of low-cost Inmarsat-C data terminals is now bringing the advantages of mobile-satellite communications to many new customers.*

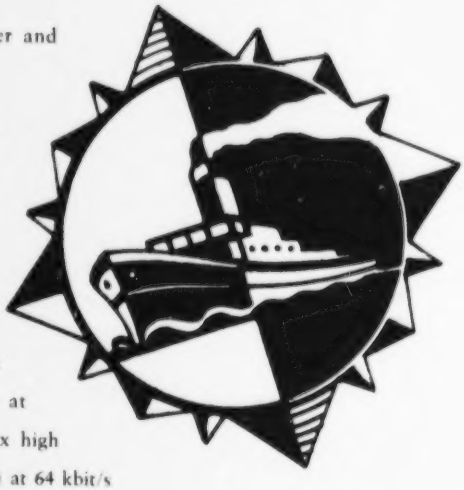
### INMARSAT-A

Inmarsat-A provides two-way, direct-dial telephone, telex, facsimile and data services between ships and off-shore platforms and the international public telecommunications networks via the Inmarsat satellite system.

As at 31 December 1991, there was a total of 12,875 Inmarsat-A Ship Earth Stations (SESs) commissioned for maritime use, a 19% increase over the previous year. Fishing and yachting markets, among the highest growth areas, have shown 25% and 12% growth respectively over the year. General cargo vessels, where there is the greatest potential for growth, constitute 19% of fittings.

Maritime traffic growth during the year was about 35% for telephony and 24% for telex – the growth due not only to the spiralling number of terminals but also an increase in the average use per terminal. With the growing popularity of Inmarsat-A for facsimile, telex traffic growth is levelling somewhat, but not as much as had been forecast.

Several Signatories offer a range of value-added services including credit card operated telephones, electronic funds transfer and electronic mail.



One way, ship-to-shore high-speed data service is now in operation at 56 kbit/s, and availability of 64 kbit/s service has been approved for Land Earth Stations (LESs) to offer at their discretion. A duplex high speed data service (DHSD) at 64 kbit/s has also been approved. Live television transmission has been demonstrated using the high speed data service and video compression techniques.

Interest in the use of Inmarsat-A for Electronic Data Interchange (EDI), particularly to speed customs and port clearance, continues to be high. Point-to multi-point data transmission channels are now provided via Inmarsat-A for fleet management applications.

### INMARSAT-C MARITIME SERVICES

Inmarsat-C service to small, relatively inexpensive data terminals began commercially on 4 January 1991

and became available in all ocean regions by the end of the year. By 31 December 1991, 1,557 Inmarsat-C maritime terminals had been commissioned.

Inmarsat-C is being used and evaluated for a number of important maritime applications. Among them:

- Inmarsat works closely with the World Meteorological Organisation to develop the use of Inmarsat-C for meteorological observations from ships.

- Inmarsat-C is being evaluated by the United States Coast Guard ship reporting service, aimed at improving maritime safety.

- The Inmarsat-C system has been used to demonstrate chart updating information for electronic navigation charts.

- Inmarsat, in cooperation with the European Commission, is improving com-munications services and developing automatic position reporting for the fishing industry.

- Fishermen can now receive up-to-the-minute information on fish prices via satellite in an innovative trial project, called Hooksat, begun in 1991.

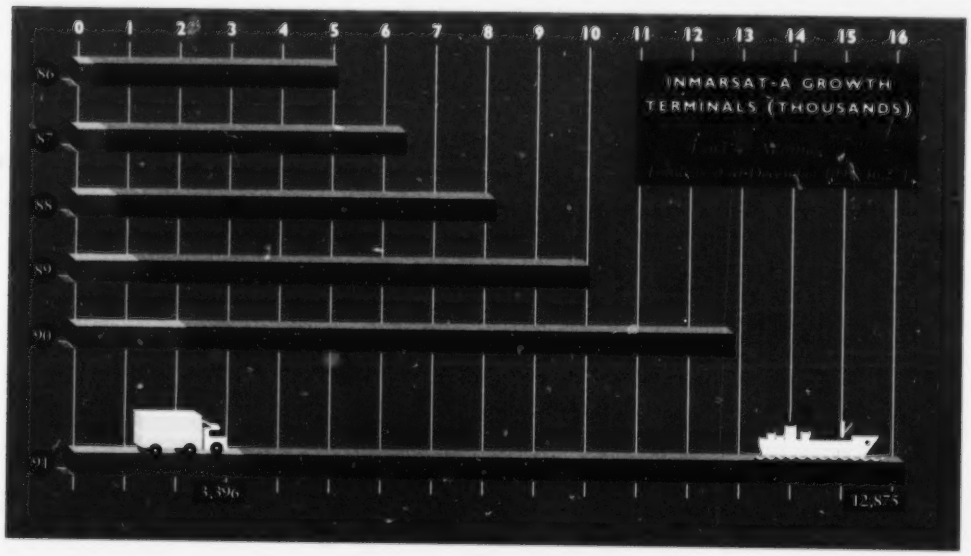
### ENHANCED GROUP CALL (EGC)

EGC allows a single message to be sent to many vessels either in a designated geographical area or to specific vessels in an ocean region and is provided through stand-alone EGC receivers or ship earth stations. Inmarsat offers two EGC services: FleetNET for fleet management applications and SafetyNET for safety-related services. In cooperation with the International Maritime Organisation, Inmarsat is developing SafetyNET to provide safety information to mariners. Trials began in 1991 with the participation of a number of countries. A newspaper service, delivered to subscribing ships by facsimile, was introduced by the Japanese Signatory in 1991.

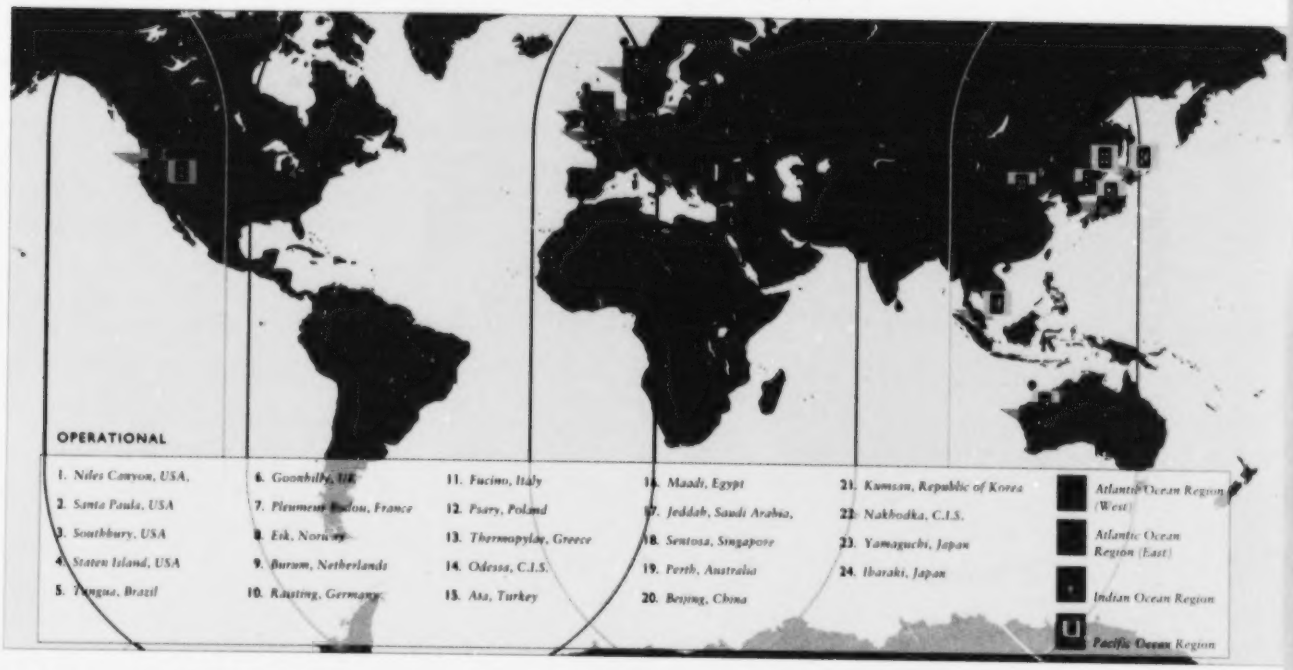
### INMARSAT-M/B

Preparations continued during the year for two new members of the Inmarsat family of communications systems which will come on stream commercially in 1992/3:

- The Inmarsat-M system, providing service to small, relatively low-cost, mobile voice terminals, will open up significant new land and maritime markets for medium quality telephony and 2400 bit/s facsimile



## INMARSAT-A EARTH STATION NETWORK (MARITIME AND LAND MOBILE)




and data communications services.

• Inmarsat-B, which provides a range of high-quality digital services, including voice, circuit switched data and fax at 9.6 kbit/s, and is designed for the large-volume mobile communications customer.

Several Signatories in 1991 announced plans for InmarsatM B land earth stations: the United Kingdom, the United States of America, the Netherlands, France, Japan, Norway, Greece and Canada. Other Signatories have expressed firm interest.

Although Inmarsat-B is designed as an eventual successor to Inmarsat-A, existing customers are assured of Inmarsat-A service availability until well beyond the millennium.

### GMDSS

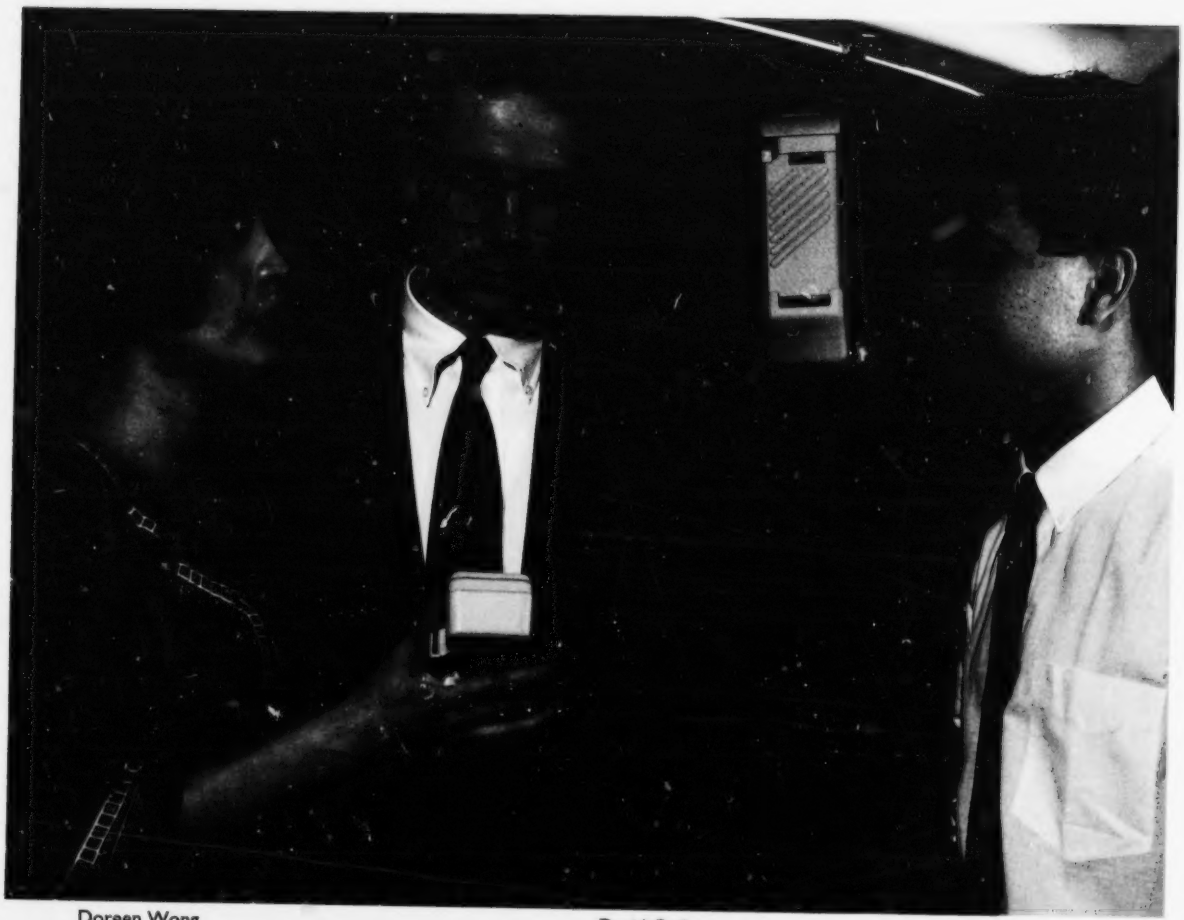
Inmarsat has worked closely with the International Maritime Organisation (IMO) in the implementation of the Global Maritime Distress and Safety System (GMDSS), beginning 1 February 1992. GMDSS integrates terrestrial and satellite communications for improved maritime safety, provides the capability to transmit instant distress alerts and coordinates search and rescue services. Inmarsat played a major role, participating in GMDSS planning and implementation and helping promote an awareness of GMDSS within the maritime community.

### FUNDING OF DISTRESS AND SAFETY SERVICES

Inmarsat, with the cooperation of the IMO, has agreed to a series of recommendations on the issue of funding for maritime satellite distress and safety communications. As of January 1992, Inmarsat offers certain maritime distress and safety communications free of space segment utilisation charges.

### TERRITORIAL SEA AND PORTS

As at 31 December 1991, 25 Inmarsat Parties had signed, or signed subject to ratification, the International Agreement on the Use of Inmarsat Ship Earth Stations in the Territorial Seas and Ports, allowing mobile-satellite services to continue to be used by ships in national waters.



Doreen Wong
Singapore International Airlines

David Coiley
Skyphone

T.C. Chan
Inmarsat

*With the introduction of commercial aeronautical services in November 1990, aircraft anywhere now have access to a full range of voice and data satellite communications, including cockpit communications, air traffic services and passenger telephone services. By 31 December 1991, 97 Inmarsat-Aero satellite communications installations had been commissioned. The growing markets include both commercial airlines and corporate aircraft.*

### THE FIRST FULL YEAR

The Inmarsat-Aero system now offers aircraft in flight both low-gain service for data communications and high-gain service for combined voice and data.

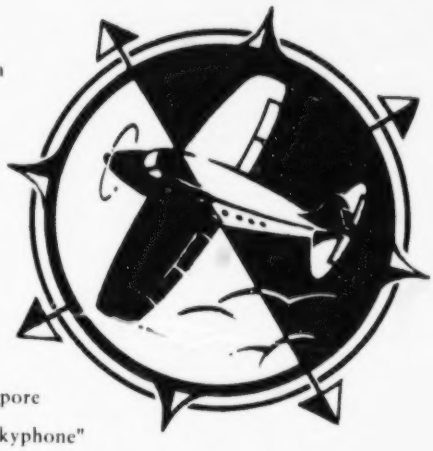
Initially, most of the installations on commercial airlines have been for low-gain data communications. The number of airlines committed to telephone installations is growing, despite 1991 having been an economically difficult year for the sector. Singapore Airlines, in September 1991, became the first airline to offer satellite passenger phones commercially.

In the first year, most of the voice (telephone) installations have been for corporate and business aircraft. In the first few months of the aeronautical service, most of Inmarsat's aeronautical traffic was generated by this sector.

Of the total number of aeronautical terminals in service at the end of the year, 38 were on commercial airliners, 52 were on corporate aircraft and seven were being used on land.

As of 31 December 1991, 10 ground earth stations (GESs), which provide the link between the satellite and terrestrial telecommunications networks, had come into service.

### SERVICE PROVIDERS



Inmarsat aeronautical services, in common with other Inmarsat services, are provided to customers through Signatories or other service providers. A number of Signatories have joined together to form three consortia for aeronautical services.

The UK, Norwegian and Singapore Signatories together provide "Skyphone" services. The Canadian, French and Australian Signatories, and USA-based IDB-Aero-Nautical have teamed up with SITA (Société Internationale des Télécommunications Aéronautiques) to provide "Satellite Aircom" services. And the USA and Japanese Signatories together offer services to Arinc (Aeronautical Radio Inc.), as does the Skyphone consortium, under the label "GLOBALink".

By the end of 1991, each consortium was capable of supporting both worldwide voice and data communications with ground earth stations (GESs) in all ocean regions. Other Signatories are considering GES installations, among them those of Germany, Italy, the Russian Federation and Portugal.

### AERONAUTICAL EQUIPMENT

The specifications for the Inmarsat aeronautical satellite communications system were developed in close cooperation with the aviation community. The system supports a host of applications, including fax and network-linked personal computers. Two avionics manufacturers currently offer avionics equipment designed to meet Inmarsat's specifications and other manufacturers are expected to enter the market. Equipment supporting a combination of up to six voice and data channels is expected to become available by late 1992. The initial system was designed for large commercial air transport and corporate aircraft, but manufacturers are also developing smaller, lighter and cheaper equipment which will appeal to a wide range of business and smaller aircraft operators.

### COMMERCIAL AIRLINE EQUIPMENT

Despite a difficult economic year for the commercial airline industry, several airlines have quickly embraced the use of satellites for both data and voice services. With an increasing number of airlines announcing their intention to acquire satellite equipment, the growth outlook for the sector is robust.

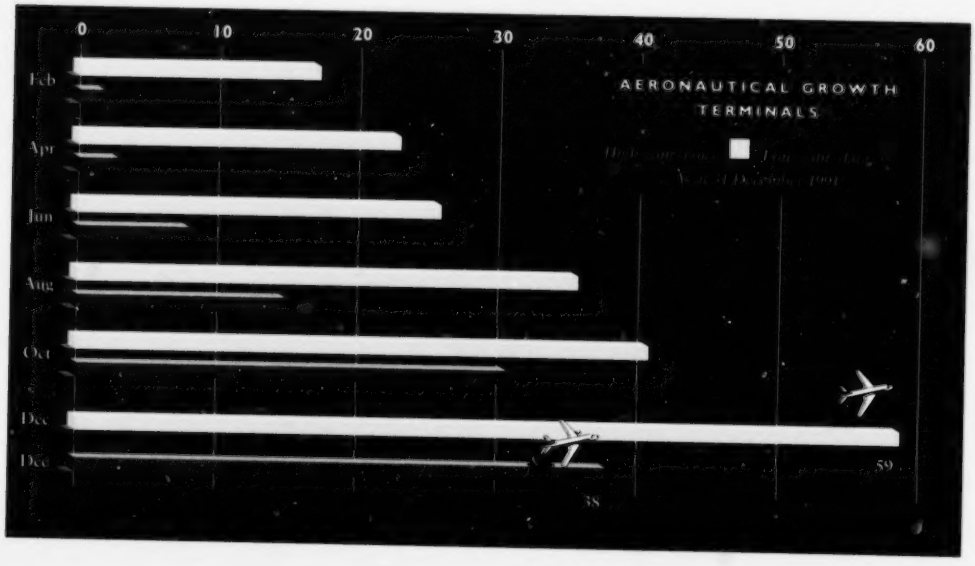
Airline interest in satellite equipment is driven by the requirement for high-quality cockpit-to-ground communications to support efficient operations while flying in regions not supported by terrestrial communications, and for voice and data communications to enhance passenger services.

In 1991, Inmarsat was working with airlines on standards for the integration of satellite equipment with aircraft cabin systems. These will be completed in 1992.

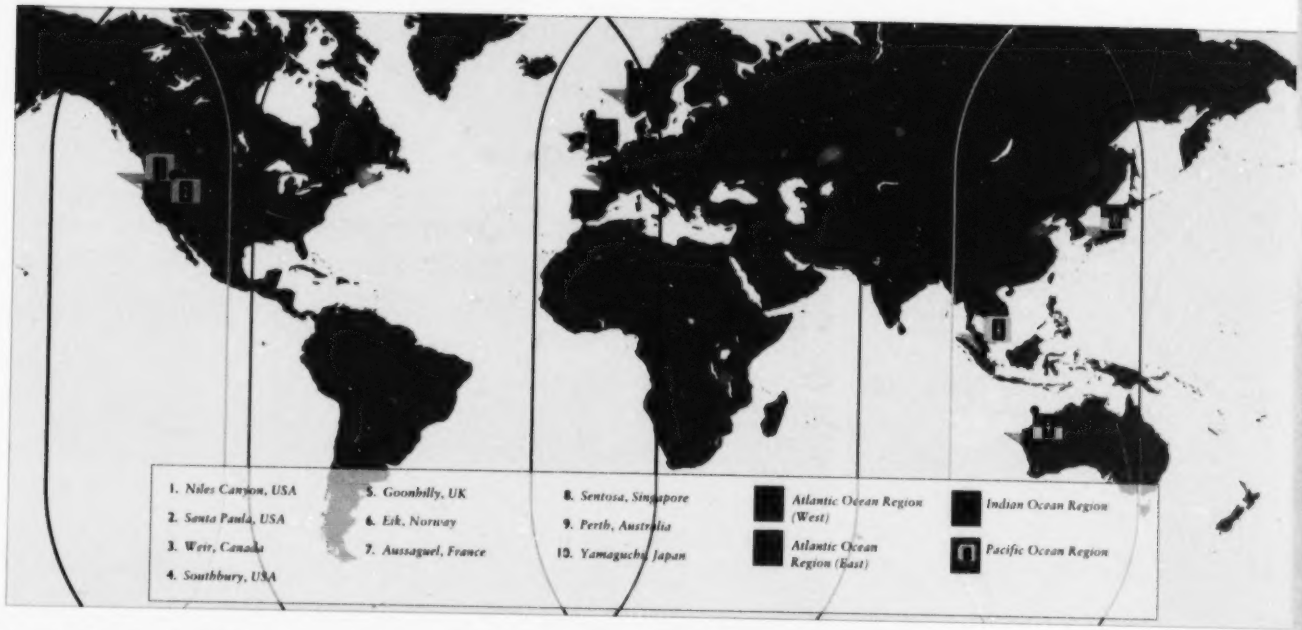
### AIR TRAFFIC SERVICES (ATS)

ATS communications provide safety related services for air traffic control, flight information and aircraft alerting and the ATS community is increasingly committed to satellites for these tasks. Responsibility for air traffic service communications rests with the aviation authorities.

The International Civil Aviation Organisation is responsible for coordinating the activities of national authorities with respect to international traffic and for establishing international standards. The majority of routine ATS service communications will be carried on digital data links, with voice limited to exceptional and emergency traffic.



## INMARSAT-AERO EARTH STATION NETWORK




A major benefit of satellite communications is in automatic dependent surveillance (ADS), a facility for continuously monitoring aircraft positions. ADS will contribute to the safe reduction of aircraft separation in oceanic airspace and permit greater route flexibility. All aircraft outfitted for Inmarsat low-gain data service can support ATS communications and ADS. Several Signatories and aviation authorities are actively implementing satellite-based ATS programmes.

In conjunction with a number of airlines, trials were undertaken in the Pacific Ocean to provide operational experience of ADS and satellite communications. The trials, conducted by Signatories and the aviation authorities in Australia, Canada, Japan and the United States of America, are leading to the operational use of satellite communications for ATS purposes.

Similar trials in the Atlantic Ocean are planned for 1992, with the participation of Signatories and air traffic authorities in Canada, Iceland and the United Kingdom.

### COOPERATION WITH THE AERONAUTICAL COMMUNITY

Inmarsat continues its close relationship with the International Civil Aviation Organisation (ICAO), participating in the work of the ICAO Special Committee on Future Air Navigation Systems (FANS) and as an observer at the Tenth Air Navigation Conference in Montreal in September 1991. The conference concluded that the use of satellite technology for air navigation provides the only viable solution for coping with future international air traffic growth and endorsed the FANS proposal for a future communications, navigation and surveillance (CNS) concept relying on satellite communications. ICAO was represented at the Eighth Session of the Inmarsat Assembly in October and has been represented at sessions of the Inmarsat Council Advisory Committee on Technical and Operational Matters.

Inmarsat has also supported several civil aviation organisations and a number of regional planning groups involved in planning CNS enhancements. These include the North Atlantic System Planning Group and the European Air Navigation Planning Group.

Jan van Genugten
DAF, Netherlands

Rudolph Buré
Inmarsat

drs Hein de Bont
PTT Telecom Netherlands

Bert Duursma
Simac

*Land mobile continues to be the fastest growing Inmarsat market, with service now reaching more than 130 countries around the world. Land-based customers are making increased use of Inmarsat-A transportable terminals for high-quality communications, and the new Inmarsat-C go-anywhere, portable data terminal. By the end of 1991, 4,399 land-based terminals of both types were in use, a 64% increase over the previous year.*

### LAND-BASED INMARSAT-A

Inmarsat-A, originally designed for maritime use, is becoming increasingly popular on land, with the widespread availability of transportable models which weigh 30-35kg, can be packed in suitcases and used anywhere. Inmarsat-A, linked by satellite to the worldwide telecommunications network, provides voice, facsimile, data and telex for hundreds of land mobile applications. Among its uses: electronic news gathering from remote locations, temporary communications in areas where there are no alternatives, commercial and government applications and support for disaster relief efforts.

A 56k bit/s high speed data (HSD) service and the introduction of 64 kbit/s one-way and two-way services further enhance the attractiveness of Inmarsat-A for specialised land-based applications, including compressed video transmission.

Standard, one-way data transmission services (at 600, 1200 and 2400 bit/s) have been developed for use with Inmarsat-A. Applications include transmission of differential corrections data, for more precise positioning than that directly obtainable from GPS and GLONASS satellites, and data broadcast applications.

As at 31 December 1991, 3,396 Inmarsat-A terminals had been commissioned for land use, a 54% increase over the previous year.

### INMARSAT-C

On 4 January 1991, Inmarsat's latest addition to a growing family of services, Inmarsat-C, entered commercial service in the Pacific Ocean Region and, by the end of the year, was available globally.

Inmarsat-C is a small, lightweight, portable data terminal which provides store and forward telex, messaging, distress alerting and data communications at 600 bit/s from virtually anywhere in the world via the Inmarsat satellite system. It is designed for both land and maritime environments.

By the end of the year, 2,539 Inmarsat-C terminals had been commissioned with 953 in use on land and 1,586 at sea. Some 27 Inmarsat-C models have now been type approved, available from 9 manufacturers. Many more are in various stages of development or type approval.

A total of 8 Land Earth Stations (LESs), which provide the link between the satellite and the international telecommunications networks, were in operation for global Inmarsat-C coverage at year end, with more planned for 1992 and beyond. Several LESs provide or are planning optional services such as data reporting, polling and Enhanced Group Call services. Optional terrestrial

interfaces such as X.25, X.400, electronic mailbox facilities and facsimile message delivery are also under development.

Inmarsat-C Network Coordination Stations (NCSs) are also operating in all four regions. They provide the facility for Inmarsat to manage the global Inmarsat-C network.

Inmarsat-C is already used to improve the efficiency of long distance road haulage, to enhance the safe carriage of hazardous, perishable or high value cargo, and to allow travellers to communicate globally from portable computers.

There is a growing use in Supervisory Control and Data Acquisition (SCADA) applications, which provide the facility for remote environmental and other monitoring. Inmarsat-C SCADA operations have been introduced in Australia and many others are planned. A model which integrates Inmarsat-C with a Global Positioning Satellite (GPS) receiver in one unit has been developed for applications where both positioning and communications are required. Another model has been case approved for use on aircraft and is undergoing inflight trials.

### INMARSAT-M/B LAND MOBILE SERVICES

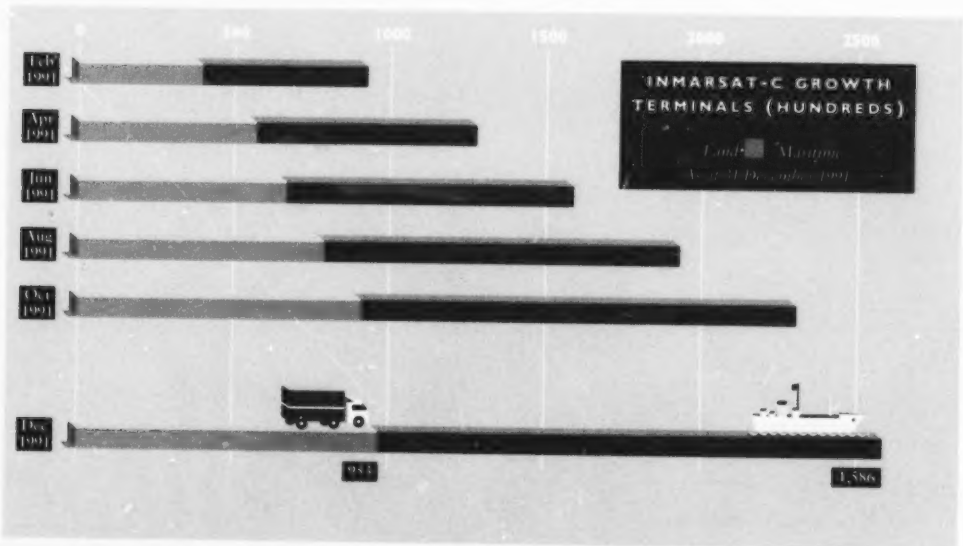
The introduction in 1992/93 of Inmarsat-M, which provides low-cost voice services from light-weight, briefcase-sized terminals, is expected to open up significant new land mobile markets. In preparation for commercial service, land mobile Inmarsat-M engineering trials began in 1991.

Inmarsat-B will be of considerable value to land-based users requiring higher-capacity communications.

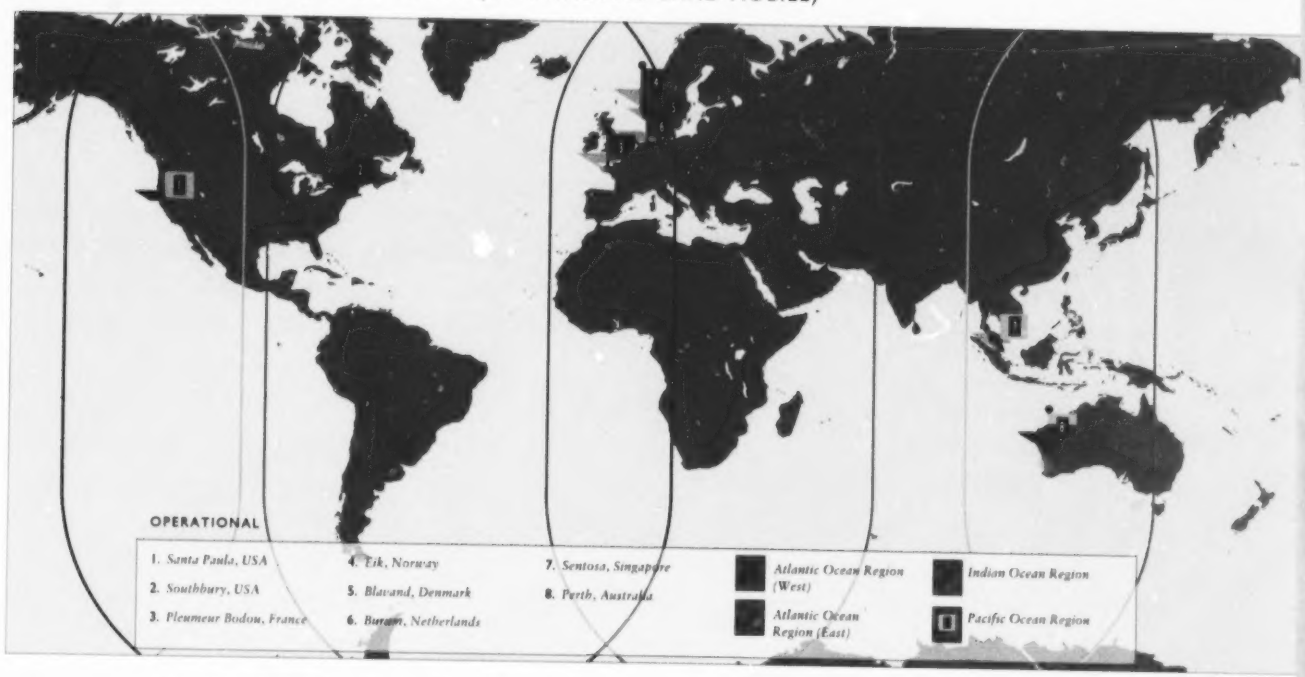
### GLOBAL SATELLITE PAGING

In November 1991, the Inmarsat Council gave the green light for the implementation of a global satellite paging service, due to be commercially introduced in 1994. It will support either pocket or vehicle mounted pagers.

The alphanumeric service is designed to meet the need for global, wide-area paging for use by both international travellers and in areas where there is no alternative means of communication. The system could also facilitate office-initiated communication from briefcase Inmarsat-C and M portable terminals carried by travellers.



## INMARSAT-C EARTH STATION NETWORK (MARITIME AND LAND MOBILE)




### INMARSAT LEASES

Five applications from Signatories to lease Inmarsat capacity, mainly for land mobile services, have been approved by the Inmarsat Council. Only two (from the USA and Canada, both for data services) are so far in service.

### INTERNATIONAL LAND MOBILE ISSUES

Many countries place restrictions on the use or importation of satellite equipment, a factor which could inhibit the future success of Inmarsat's land mobile service. Meetings were held to discuss the issue with the Asia-Pacific Telecommunity, the Pan-African Telecommunication Union and the Inter-American Telecommunications Conference (CITEL). In October 1991, a Meeting of Experts attended by representatives of 33 countries and 16 international organisations unanimously agreed that governments should allow the transport of mobile-satellite communications terminals across borders and simplify regulations for their use in commercial and disaster relief operations.

Inmarsat played an active role in the International Telecommunication Union CCIR Study Group which is addressing future public land mobile telecommunication systems.

### DISASTER RELIEF COMMUNICATIONS

Extensive use has been made of the emergency facilities available from transportable Inmarsat-A and Inmarsat-C terminals. Under certain circumstances, Inmarsat provides limited free use of the space segment for disaster relief coordination efforts. Inmarsat cooperates with several United Nations agencies associated with disaster relief and development programmes.

### LAND MOBILE AMENDMENTS

As at 31 December, amendments to the Convention and Operating Agreement, which extend Inmarsat's mandate to include land mobile services, had been approved by 19 Parties and Signatories.

*Navigation is quickly emerging as a universally desired "utility". The nationally operated GPS (USA) and GLONASS (Russian Federation) systems are already changing the face of navigation, surveying and timekeeping and have been offered for international civil use. However, there is an increasing recognition of the need for an independent, international, civil satellite navigation system as a follow on. The radio-determination and navigation capabilities enabled by Inmarsat-3 could be a first step in the development of such a system.*

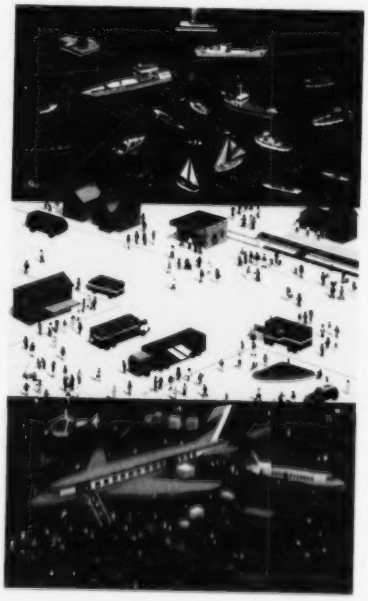
### INMARSAT AND NAVIGATION

Position reporting and surveillance are becoming important to fleet management on land, in the air, and at sea. Inmarsat has fostered the development of integrated communications/navigation equipment and continues to investigate ways in which the precise timing, frequency and positioning provided by radio determination type signals could lead to further service enhancements and applications.

Inmarsat offers point-to-multipoint data distribution and multipoint-to-point data collection capabilities which are used in conjunction with differential techniques for GPS and GLONASS, for positioning accuracies better than those obtainable without such augmentation. Inmarsat-sponsored research is expected to demonstrate that differential corrections may be provided over wide areas, possibly an entire ocean region, and that multipoint distribution may be extended in the future to smaller mobile earth stations.

To facilitate greater civil acceptance of global satellite navigation, the Inmarsat-3 navigation payloads will permit the augmentation of the two national systems and the introduction of an external global (navigation) integrity channel (GIC), which may be required by the aeronautical community in particular. The integrity data carried in the GIC are expected to be provided by appropriate national or multi-national agencies responsible for navigation aids. Inmarsat has cooperated with a number of organisations in formulating test plans for a GIC and requirements for its operation. Inmarsat also continued to develop and improve its own PN Test Bed and to participate in various fora dealing with satellite navigation integrity.

Inmarsat is particularly well positioned to play a key role in the development of a future global civil satellite navigation system. A number of observers have recognised that Inmarsat offers a convenient vehicle for a future transition from the national GPS and GLONASS systems to an international one.



### INMARSAT REVIEW

In September 1991, the Inmarsat Assembly established an intersessional working group to review "the objectives and processes of Inmarsat in view of the changing telecommunications environment and the challenges of competition". Results of the review, which could lead to changes in Inmarsat's Convention and Operating Agreement, will be presented at the next Assembly meeting in 1993. In the first year of the review, the focus is on Article 8 of the Inmarsat Convention.

### NEW HEADQUARTERS

Inmarsat has signed an agreement to purchase a building located at 99 City Road, London EC1, UK, for its headquarters. The move from its current rental premises at 40 Melton Street, London NW1, will occur in 1993.

*New Headquarters Building.*

### RESEARCH AND DEVELOPMENT PROGRAMME

Inmarsat has carried out a Research and Development programme to support technology and services. In 1991, the programme included research in transmission planning, new applications of existing services, new services definition and future space segments.

### PROGRAMME OF COOPERATION WITH DEVELOPING COUNTRIES

Inmarsat's programme of cooperation with developing countries is aimed at increasing awareness of the benefits of mobile-satellite communications in countries around the world.

During 1991, Inmarsat sponsored a number of Inmarsat-C demonstrations in the People's Republic of China, Colombia, Congo, the Ivory Coast, Egypt, Ethiopia, Guinea, Liberia, Malawi, Nigeria, Papua New Guinea, Peru, Senegal and Zaire. Inmarsat also supported a trial by UNCTAD and demonstrations in Greece and Sri Lanka. In addition, assignees to Inmarsat were accepted from Chile, Cuba, Czechoslovakia, Guinea, Guyana, Kenya, Malaysia, Mexico, Nigeria, Papua New Guinea, the Philippines, Singapore, Syria, Tanzania, Turkey and Zaire for training sessions and seminars.

A highly successful conference held at Yaoundé, Cameroon, in September, organised by Inmarsat and the Pan-African Telecommunications Union (PATU), was attended by delegates from virtually all African countries.

| Member State | Signatory | Investment Share % |
|---|---|---|
| USA | Communications Satellite Corporation (COMSAT) | 24.97482 |
| NORWAY | Norwegian Telecom | 12.79608 |
| UNITED KINGDOM | British Telecom plc | 12.55480 |
| JAPAN | Kokusai Denshin Denwa Co Ltd | 9.20774 |
| FRANCE | France Telecom | 4.83429 |
| RUSSIAN FEDERATION * | Morsviazsputnik | 4.04592 |
| NETHERLANDS | PTT Nederland N.V. | 2.54743 |
| GREECE | Hellenic Telecommunications Organization (OTE) | 2.51506 |
| DENMARK | Tele Danmark A/S | 2.32536 |
| SINGAPORE | Telecommunication Authority of Singapore | 2.26912 |
| ITALY | Telespazio S.p.A. | 2.20093 |
| GERMANY | Deutsche Bundespost TELEKOM | 2.20057 |
| SPAIN | Telefonica de Espana S.A. | 1.99799 |
| CANADA | Teleglobe Canada Inc | 1.87198 |
| AUSTRALIA | OTC Limited | 1.59340 |
| BRAZIL | Empresa Brasileira de Telecomunicacoes S.A. (EMBRATEL) | 1.58959 |
| SAUDI ARABIA | Ministry of Posts, Telegraphs and Telephones | 1.52807 |
| SWEDEN | Swedish Telecom Radio | 1.05893 |
| KOREA, REPUBLIC OF | Korea Telecom | 0.79958 |
| BELGIUM | Regie des Telegraphes et des Telephones | 0.70455 |
| POLAND | Ministry of Transport, and Maritime Economy | 0.54708 |
| INDIA | Videsh Sanchar Nigam Limited | 0.46804 |
| SWITZERLAND | Swiss PTT | 0.36995 |
| IRAN | Telecommunication Company of Iran | 0.35187 |
| FINLAND | Telecom Finland | 0.35052 |
| UNITED ARAB EMIRATES | Ministry of Communications | 0.33900 |
| CHINA, PEOPLE'S REPUBLIC OF | Beijing Marine Communications and Navigation Company | 0.32984 |
| INDONESIA | Indonesian Satellite Corporation (PT INDOSAT) | 0.28748 |
| PORTUGAL | Companhia Portuguesa Radio Marconi | 0.27217 |
| KUWAIT | Ministry of Communications | 0.26267 |
| EGYPT | National Telecommunications Organisation (ARENTO) | 0.24691 |
| ARGENTINA | Comision Nacional de Telecomunicaciones | 0.23812 |
| NEW ZEALAND | Telecom Corporation of New Zealand Limited | 0.18672 |
| BULGARIA, REPUBLIC OF | Shipping Corporation "Voden Transport" | 0.16757 |
| LIBERIA | Republic of Liberia | 0.15456 |

| Member State | Signatory | Investment Share % |
|---|---|---|
| MALAYSIA | Syarikat Telekom Malaysia Berhad | 0.14851 |
| PHILIPPINES | Philippine Communications Satellite Corporation (PHILCOMSAT) | 0.12256 |
| QATAR | Qatar Public Telecommunication Corporation (Q-TEL) | 0.11511 |
| MONACO | Government of Monaco | 0.09721 |
| TURKEY | General Directorate of PTT | 0.09423 |
| BAHRAIN | Ministry of Transportation | 0.07932 |
| YUGOSLAVIA | Community of Yugoslav Posts, Telegraphs and Telephones | 0.07475 |
| PANAMA | Instituto Nacional de Telecommunicaciones (INTEL) | 0.07470 |
| ISRAEL | Government of Israel | 0.07004 |
| GABON | Telecommunications Internationales Gabonaises (TIG) | 0.06818 |
| CHILE | Empresa Nacional de Telecomunicaciones S.A. (ENTEL-CHILE) | 0.06668 |
| ALGERIA | Ministere des Postes et Telecommunications | 0.05000 |
| CAMEROON | International Telecommunications Organisation of Cameroon (INTELCAM) | 0.05000 |
| COLOMBIA | Empresa Nacional de Telecomunicaciones (TELECOM) | 0.05000 |
| CUBA | Ministry of Communications | 0.05000 |
| CZECHOSLOVAKIA | Federal Ministry of Posts and Telecommunications | 0.05000 |
| ICELAND | Post and Telecommunications Administration | 0.05000 |
| IRAQ | Iraqi Telecommunication and Posts | 0.05000 |
| MALTA | Telemalta Corporation | 0.05000 |
| MOZAMBIQUE | Empresa Nacional de Telecomunicacoes de Mocambique, E.E. | 0.05000 |
| NIGERIA | Nigerian Telecommunications Limited (NITEL) | 0.05000 |
| OMAN | Sultanate of Oman | 0.05000 |
| PAKISTAN | Pakistan Telecommunication Corporation | 0.05000 |
| PERU | ENTEL-PERU S.A. | 0.05000 |
| ROMANIA | Ministry of Communications | 0.05000 |
| SRI LANKA | Overseas Telecommunication Service | 0.05000 |
| TUNISIA | Republic of Tunisia | 0.05000 |
| TOTAL | | 100.00000 |

* Includes the investment shares of Byelorussian and Ukrainian SSR's

From 1 January 1992 the Russian Federation replaces the USSR, as Party, in respect of Russian territory only.

## SIGNATORIES REPRESENTED ON THE INMARSAT COUNCIL - 1991

Signatories or groups of signatories of the following Inmasat Parties were represented on the Council as at 31 December 1991:

United States of America

United Kingdom

Norway

Japan

France/Monaco

Russian Federation/Bulgaria/Czechoslovakia

Netherlands/Belgium

Greece

Saudi Arabia/Kuwait/United Arab Emirates/Qatar/Oman/Bahrain

Denmark

Germany

Italy

Singapore

Spain/Colombia

Brazil/Portugal/Cuba/Peru

Canada

Australia

Sweden/Finland

Poland

China, People's Republic of

Chile

Nigeria

## OFFICERS OF THE EIGHTH INMARSAT ASSEMBLY

The Eighth session of The Inmarsat Assembly met from 24 to 26 September 1991 with the following persons serving as officers:

| | |
|---|---|
| Mr G Evans *(Australia)* | CHAIRMAN |
| Mr GM Mbog *(Cameroon)* | VICE-CHAIRMAN |
| Mr J Broudre-Groger *(Germany)* | VICE-CHAIRMAN |
| Mrs R Navarro-Tolentino *(Philippines)* | VICE-CHAIRMAN |

*The ninth session of the Inmarsat Assembly will meet during the last quarter of 1993.*

## OFFICERS OF THE INMARSAT COUNCIL - 1991

| | |
|---|---|
| Mr S Demyati (Saudi Arabia) | CHAIRMAN OF THE COUNCIL |
| Mr RKT Fong (Singapore) | VICE-CHAIRMAN OF THE COUNCIL |
| Mr J Jensen (Denmark) | CHAIRMAN OF THE ADVISORY COMMITTEE ON TECHNICAL AND OPERATIONAL MATTERS (ACTOM) |
| Mr DW Swearingen (United States) | VICE-CHAIRMAN OF ACTOM |
| Mr G Morris (Greece) | CHAIRMAN OF THE FINANCE COMMITTEE |

## OFFICERS OF THE INMARSAT DIRECTORATE

| | |
|---|---|
| Olof Lundberg | DIRECTOR GENERAL |
| Noel Isotta | DIRECTOR GENERAL'S DEPUTY |
| Ahmad Ghais | DIRECTOR, ENGINEERING AND OPERATIONS |
| Eugene Jilg | DIRECTOR, SATELLITE PROGRAMMES |
| Keith Thacker | GENERAL MANAGER, MARITIME SERVICES |
| Guntis Berzins | GENERAL MANAGER, AERONAUTICAL SERVICES |
| Jai Singh | GENERAL MANAGER, LAND MOBILE AND SPECIAL SERVICES |
| Ramin Khadem | DIRECTOR, FINANCE AND ADMINISTRATION |
| George Symeonidis | DIRECTOR, CORPORATE AFFAIRS |
| Wolf von Noorden | GENERAL COUNSEL |

INMARSAT

40 Melton Street London NW1 2EQ

United Kingdom

Telephone: National 071 728 1000 International +44 71 728 1000

Telex: 297201 INMSAT G. Facsimile: +44 71 728 1044

*Designed and produced by Hollenstein Veal. Photographs Alexandra Burke. Illustration Richard Deverell*